Benefits of NeuCo Power Project

Clean Coal Power Initiative

Demonstration of Integrated Optimization Software at Baldwin Energy Complex

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Executive Summary

- **Demonstration projects are critical to successful commercialization of technology developed under DOE's Fossil Energy R&D program.**
- **Successful commercial application of Integrated Optimization Software System in United States would significantly reduce emissions.**
  - 13,420 tons per year of NO_x with Cyclone Optimization Product
  - 64,990 tons per year of NO_x with Sootblowing Optimization Product
- **By installing optimization technologies, power companies could save annually $7.5 million for SCR units, $28.6 million for sootblowing operation, $51.5 million for performance improvement, and $51.5 million for profit optimization.**

Outline

- **Description of Integrated Optimization Software System.**
- **Quantitative estimates of benefits of NeuCo Power project.**
  - Benefits to Nation
  - Benefits at Dynegy Midwest Generation's Baldwin Energy Complex
- **Approach used to calculate benefits.**

NeuCo Power Project

- **Demonstration of Integrated Optimization Software System on three coal-fired units with a total of 1765 MW_e at Dynegy Midwest Generation's Baldwin Energy Complex in Baldwin, Illinois.**
- **Units 1 and 2 consist of cyclone-fired (2x585 MW_e) boilers with SCR systems, and Unit 3 consists of a tangentially-fired (595 MW_e) boiler with low-NO_x burners.**

Baldwin Energy Complex

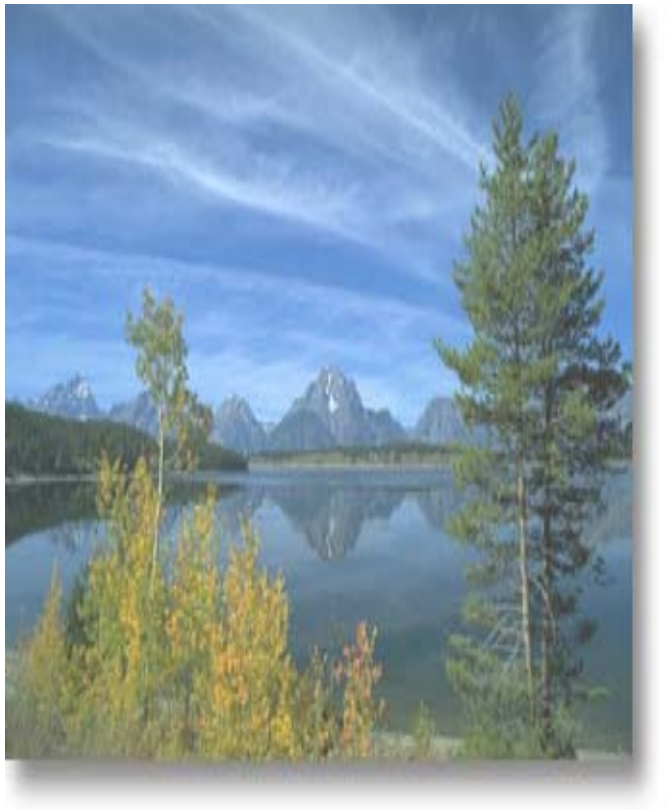
Baldwin Energy Complex Control Room

SCR Installed on Unit 2 at Baldwin Energy Complex

Integrated Optimization Software System

- Integrate existing controls, control systems, sensors and computer hardware with advanced optimization techniques.
- Reduce emissions, increase efficiency, and increase reliability.
- Includes five optimization modules: Cyclone Combustion, Sootblowing, SCR Operations, Performance, and Profit Optimization.
- Integrated technology performance objectives: Reduce NO_x emissions by 15%, improve heat rate and annual MWh output by 1.5%, extend SCR catalyst life by one year and reduce NH_3 consumption by 15%.
- Expect five products (modules) to be installed on 214 GW of fossil fuel-fired capacity.

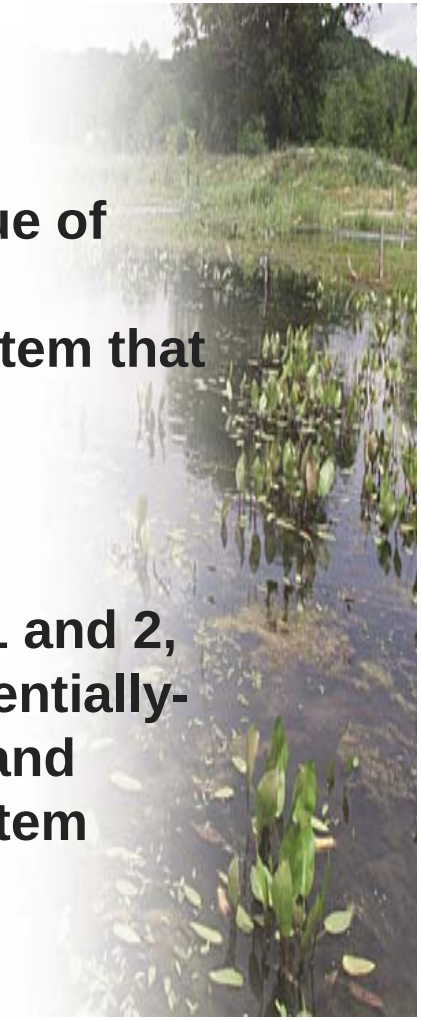
Advantages of Integrated Optimization Software System



- Heat rate improvement.
- Increase in annual MWh.
- NO_x emissions reductions.
- SCR catalyst life extension and reduction in NH_3 consumption.
- Reductions in greenhouse gases, mercury, and particulates.
- Increased efficiency and improved reliability would result in lower costs to consumer and an increase in profitability to power company.

Drivers for Baldwin Energy Complex to Conduct Project

- Corporate commitment to environmental responsibility.
- A pro-active power producer that realizes value of advanced technologies such as economically feasible Integrated Optimization Software System that remains competitively viable.
- An anticipation of more stringent emissions regulations for utility boilers in future.
- Current SCR systems on cyclone-fired Units 1 and 2, and low-NO_x burners with overfire air on tangentially-fired Unit 3 increase complexity of operation and provide Integrated Optimization Software System operating challenges.



Competing Technology Options

- **Boiler Tuning**
- **Computational Fluid Dynamics Modeling**
- **Utility Industry Software Applications**

Estimated NO_x Reductions in National Pollution Emissions from Commercialization

	Emissions Reductions, tons/year	Current NO_x Emissions from all Coal-fired Boilers in United States, tons/year
Cyclone Optimization	**13,420** Basis: Technology market penetration of 4.1 GW_e	**4,766,000**
Sootblowing Optimization	**64,990** Basis: Technology market penetration of 47.2 GW_e	**4,766,000** Basis: McIlvaine Company 2000 NO_x tons

Additional National Benefits from Commercialization

- **Integrated Optimization Software System could result in cost savings:**
  - $7.5 million/yr for reduced NH_3 consumption and extended catalyst life for SCR operation.
  - $28.6 million/yr for 0.5% increased annual MWh output / heat rate improvement for sootblowing optimization.
  - $51.5 million/yr for 0.5% increased annual MWh output / heat rate improvement for plant performance optimization.
  - $51.5 million/yr for 0.5% increased annual MWh output for profit optimization.

Benefits of Technology for Baldwin Energy Complex

	Total NO_x Emissions, tons/year
Before Retrofit	26,020
After Retrofit	24,720
Emissions Avoided	1,300

Total NO_x Emissions at Baldwin Energy Complex are estimated to decrease by about 5% due to installation of Integrated Optimization Software System.

Additional Benefits for Baldwin Energy Complex

- **Integrated Optimization Software System technology is estimated to annually save about $1,780,000 for combustion optimization, $2,047,000 for sootblowing optimization, $426,000 for SCR operations optimization, $1,478,000 for performance optimization, and $721,000 for profit optimization, i.e., a total cost savings of $6,452,000 annually at Baldwin Energy Complex.**

Benefits of Increased Power Output

- **Technology provides additional electric power while reducing NO_x emissions without increasing emissions of other pollutants.**
  - 175 GWh increase in electricity produced over a year's time at Baldwin Energy Complex.
  - 5,625 GWh increase in electricity produced over a year's time from commercialization throughout nation.

Approach to Estimating Benefits

- **Forecast market penetration.**
- **Quantify anticipated performance of Integrated Optimization Software System being demonstrated.**
  - Pollutant emissions, tons per year
  - Cost savings associated with improvement in increased annual MWh output
  - Cost savings associated with improvement in SCR operations
  - Capital cost, constant dollars

Assumed Market Penetration

- **Individual boilers most likely to install Integrated Optimization Software System were selected from NETL Coal Power Data Base, McIlvaine Company Utility Environmental Upgrade Tracking System, and UDI North American Energy Business Directory.**
- **These target boilers were selected based on specific attributes that made them most likely to benefit from this technology.**
  - Greater than or equal to 50 MW capacity for all five product optimization modules
  - For Cyclone Combustion Optimization Product, cyclone boilers
  - For Sootblowing Optimization Product, coal-fired plants
  - For SCR Optimization Product, coal-fired plants equipped with SCR
  - For Performance and Profit Optimization Products, coal, gas, and oil-fired plants in operation or construction pending mode, and unit type as steam turbine, also with heat recovery and steam sendout

Assumed Market Penetration (continued)

- **Total Market Potential**
  - Cyclone Combustion Optimization Product, 28 GW_e (100 boilers)
  - Sootblowing Optimization Product, 315 GW_e (1,066 boilers)
  - SCR Optimization Product, 121 GW_e, (234 boilers)
  - Performance Optimization Product, 485 GW_e, (1,688 boilers)
  - Profit Optimization Product, 485 GW_e, (1,688 boilers)

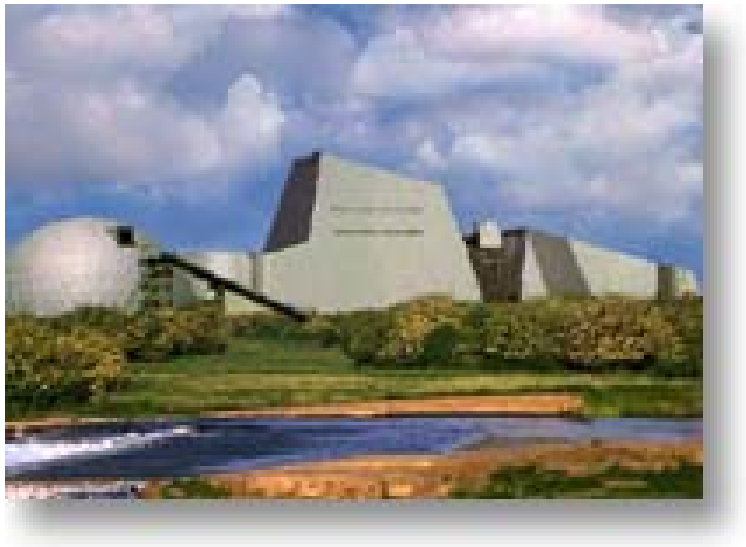
- **Assumed market penetration of 15%**
  - Cyclone Combustion Optimization Product, 4.1 GW_e, (15 boilers)
  - Sootblowing Optimization Product, 47 GW_e, (160 boilers)
  - SCR Optimization Product, 18 GW_e, (35 boilers)
  - Performance Optimization Product, 72 GW_e, (250 boilers)
  - Profit Optimization Product, 72 GW_e, (250 boilers)

Differences in Performance - Total NO_x Emissions-

- Total NO_x emissions currently emitted by individual boilers most likely to install this technology were calculated using McIlvaine Company Utility Environmental Upgrade Tracking System database.
- Total NO_x emissions reductions after installation of two technology products on these boilers were estimated by taking 15% of current emissions for Cyclone Optimization Product technology, and 10% of current emissions for Sootblowing Optimization Product technology.

Conclusions

- **There are significant benefits to nation that will be realized by commercialization of technologies being demonstrated in Clean Coal Power Initiatives.**



Visit NETL web site for information on all Power Plant Improvement Initiative and Clean Coal Power Initiative projects.

www.netl.doe.gov/coalpower/ccpi